Center Independent Research & Development: GSFC IRAD

Silicon Carbide Printed Structures

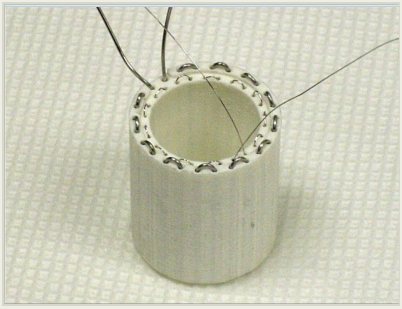
Completed Technology Project (2017 - 2018)

Project Introduction

The plan is to design a process that will allow precision fabrication of SiC structures using a sterolithographty printer and an oven process to sinter the material to meet our space flight requirements, using similar techniques that I have used in the past working with a local vendor. In the past, we created a process that allowed us to fabricate complex (but un-machinable) precision alumina oxide parts that flew on space flight projects. The plan for this IRAD is to develop a similar process that works with SiC. This technology can be used for many applications; one is as an optical support structure for the LISA project. The LISA project has already been testing different materials that would provide a structure with a very low (stable) CTE and have good thermal conductance to assure accurate measurements over the project specified time. Tests by the LISA project have shown that SiC would be an optimum material. However, working with SiC (like Alumina Oxide) has shown that it is very difficult to fabricate parts. We would like to work with a local vendor to source a sinterable SiC powder and resin formulation. This material will be (3D printed) laser photo-cured to produce a green structure that can be de-binded followed by a sintering process. Using sintering methods, we will iterate these processes to remove macro defects. The goal of this proposal will be to build samples for visual inspection and to test CTE and strength. Test parts will be tested in our GSFC code 544 labs, and the CTE tests will be conducted by the LISA project (already existing test setup).

Anticipated Benefits

SiC has great thermals properties (thermally conductive and low CTE) but it is a difficult material to machine or produce parts out of. Some GSFC flight projects such as the LISA project and concepts such as LUVOIR require a low CTE material to provide dimensionally stable optical structures.



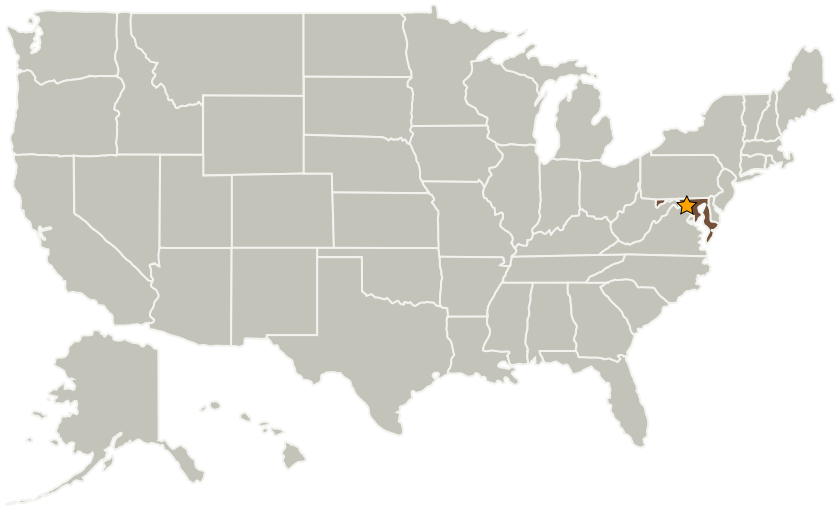
pyro-oven-fm-heater (2)

Table of Contents

Silicon Carbide Printed Structures

Completed Technology Project (2017 - 2018)

Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
★Goddard Space Flight Center(GSFC)	Lead Organization	NASA Center	Greenbelt, Maryland

Co-Funding Partners	Type	Location
Army Research Lab(ARL)	US Government	Adelphi, Maryland

Primary U.S. Work Locations
Maryland

Organizational Responsibility

Responsible Mission Directorate:

Mission Support Directorate (MSD)

Lead Center / Facility:

Goddard Space Flight Center (GSFC)

Responsible Program:

Center Independent Research & Development: GSFC IRAD

Project Management

Program Manager:

Peter M Hughes

Project Managers:

Megan E Eckart
Timothy D Beach
Charles D Butler

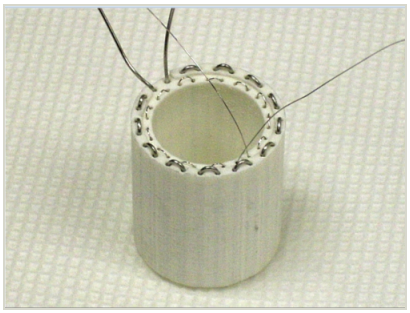
Principal Investigator:

Patrick J Jordan

Silicon Carbide Printed Structures

Completed Technology Project (2017 - 2018)

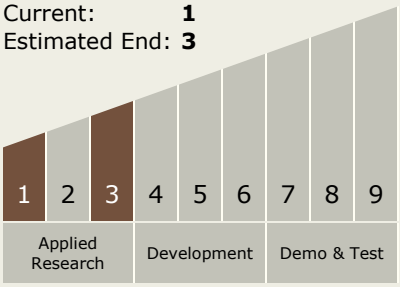
Images



Ceremic Part
pyro-oven-fm-heater (2)
(https://techport.nasa.gov/image/28311)

Technology Maturity (TRL)

Start: **1**
Current: **1**
Estimated End: **3**



Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
  - TX12.4 Manufacturing
    - TX12.4.2 Intelligent Integrated Manufacturing

Target Destinations

Others Inside the Solar System, Outside the Solar System, Foundational Knowledge

Supported Mission Type

Planned Mission (Pull)